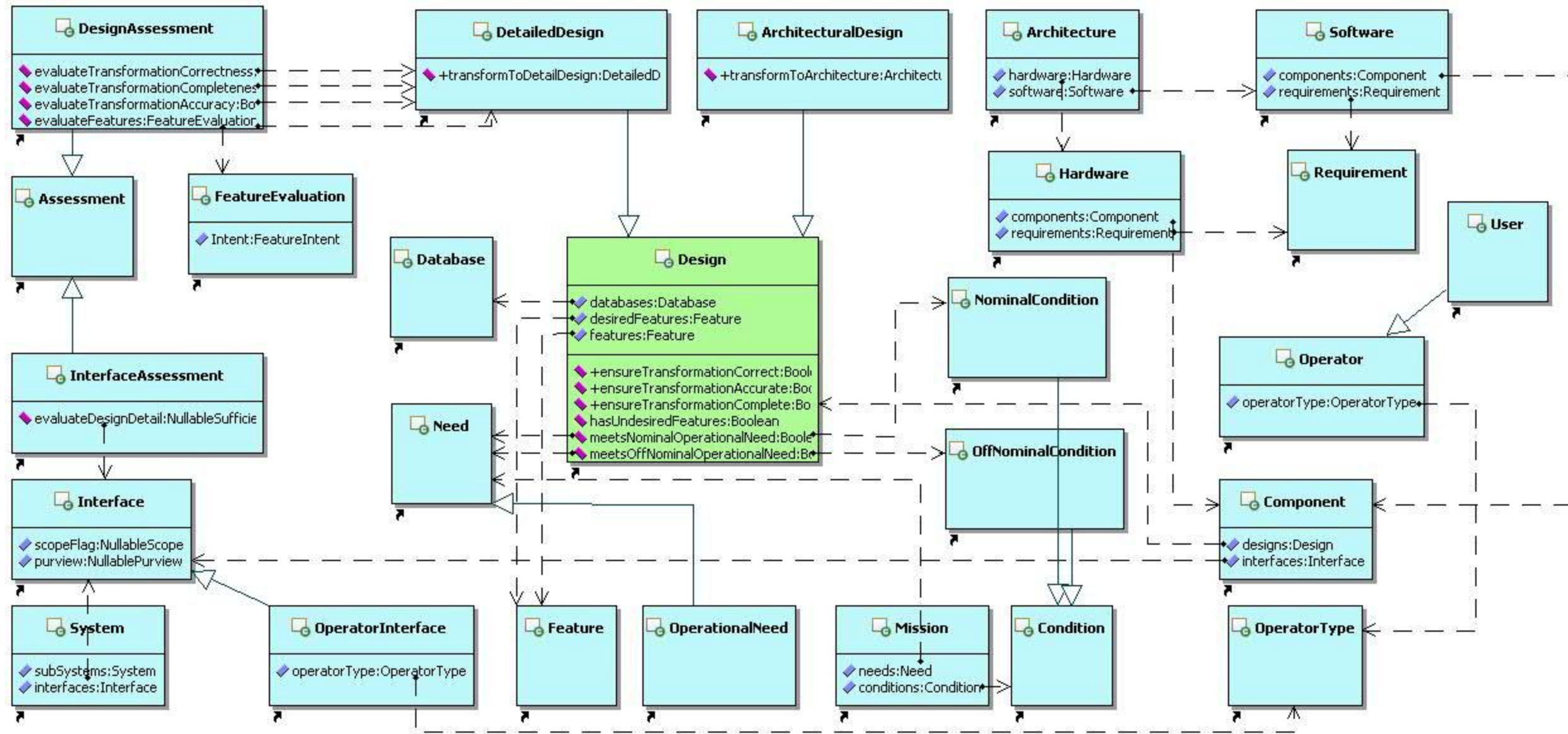# Verifying & Validating Design

Role of Design IV&V

A well structured design is of utmost criticality when designing a system meant to orbit around the planet. Other than the obvious case of costly repairs, a single inconsistency of software design can render a satellite or other invaluable mission centerpiece another piece of space debris. At The NASA Independent Verification and Validation Facility, engineers and scientists work to ensure that the possibility of mission failure is mitigated by independently analyzing the software design as it is being developed. So how does IV&V verify and validate design? Here's how.
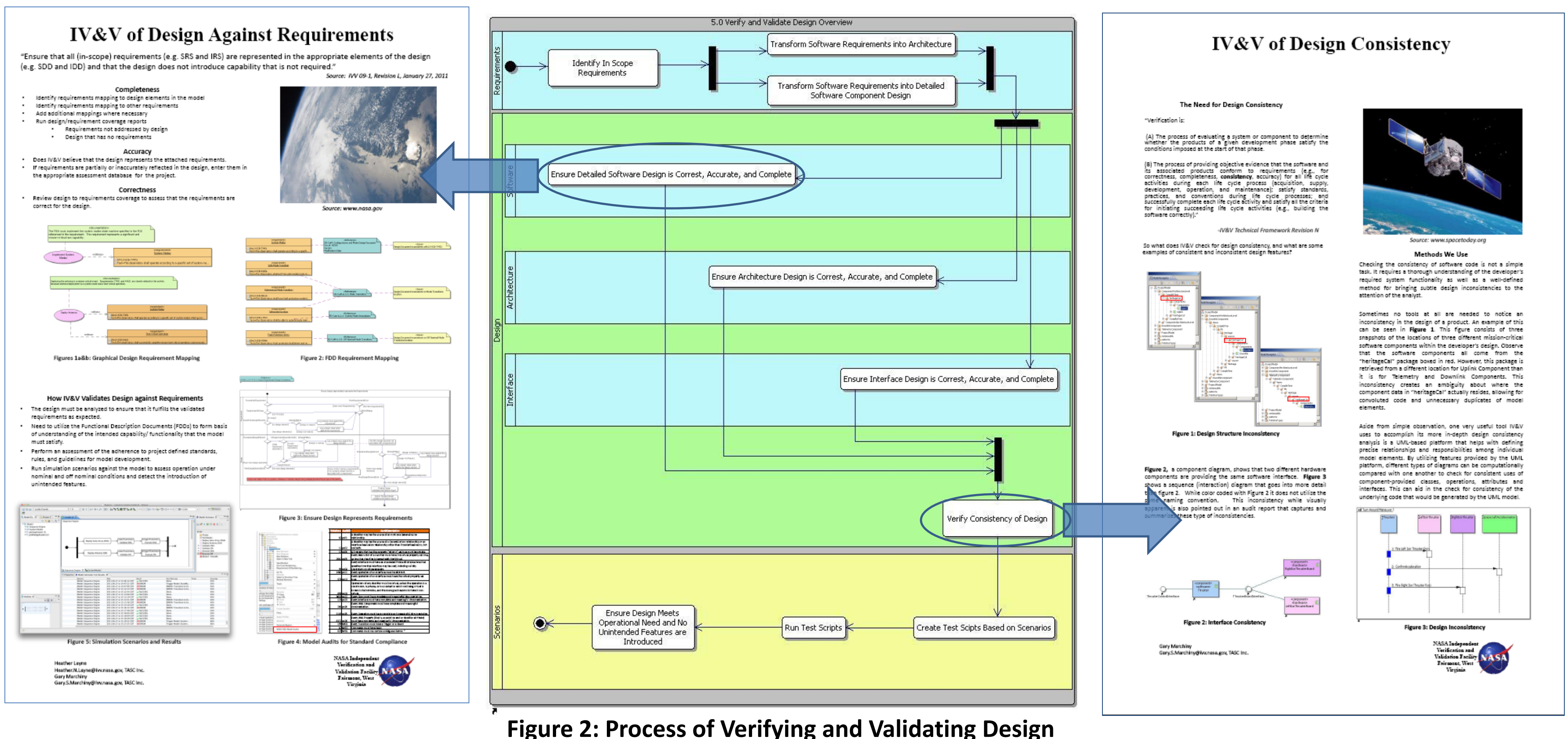
Verify and Validate Design

"In software design, software requirements are transformed into an architecture and a detailed design for each software component. The design also includes databases and system interfaces (e.g., hardware, operator/user, software components, and subsystems). Design IV&V addresses software architectural design and software detailed design. The objective of Design IV&V is to ensure that the design is a correct, accurate, and complete transformation of the software requirements that will meet the operational need under nominal and off-nominal conditions and that no unintended features are introduced …"

- IVV 09-1 IV&V
Technical Framework, Revision N

Figure 1: Design Elements Domain Model

A Static View

As mentioned in the quote above, there are many different "parts" of a design that must be examined. **Figure 1** illustrates the relationships between these key parts of the design that will be verified and validated. This static view of the design and its contributories is useful in understanding the purpose of each piece of the design, and is essential in checking key qualities such as consistency.

Getting Dynamic

Below is an activity diagram that delineates the process of verifying and validating the design. This is a similar text-to-diagram transformation of the process mentioned above from the "Technical Framework" document. But where the above diagram was a *static* representation of this text, **Figure 2** is a *dynamic* view. Often when verifying and validating design, these two different aspects both must be analyzed to ensure correctness, accuracy, completeness and consistency. This dynamic form is quite useful in ensuring that the design behaves as planned (i.e. "will meet the operational need under nominal and off-nominal conditions and that no unintended features are introduced…") Notice that two of the actions of **Figure 2** are expanded on in two separate posters to further detail the verification and validation of design process.

Figure 2: Process of Verifying and Validating Design

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